1. General Description

The WP250152S3-B is a current limited P-channel MOSFET power switch designed for high-side load switching applications. This switch operates with inputs ranging from 2.5V to 5.2V, making it ideal for both 3.3V and 5V systems. An integrated current-limiting circuit protects the input supply against large currents which may cause the supply to fall out of regulation. When the output voltage exceeds than input voltage. A reverse current limit feature is implemented to limit such back currents. The WP250152S3-B includes thermal shutdown protection that prevents damage to the device when a continuous over-current condition causes excessive heating by turning off the switch. The load of the switch can be up to 0.15A. The quiescent current is only 100μA.

The WP250152S3-B is available in Pb-free packages and is characterized for operation over the free-air temperature range of - 40℃ to 85℃.

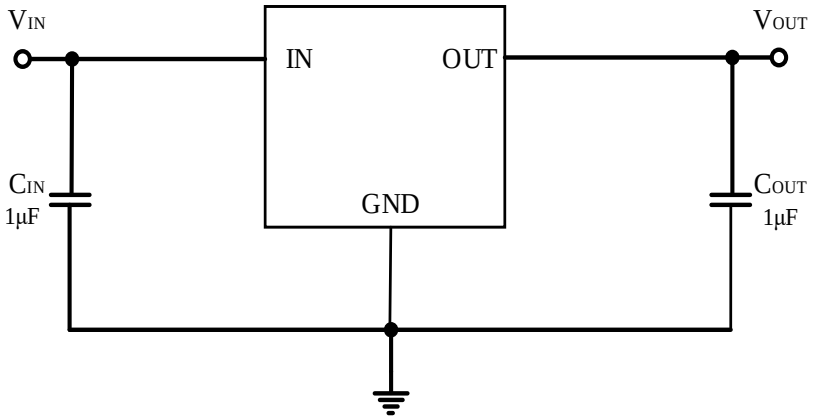
2. Features

- Input Voltage Range: 2.5V to 5.2V
- 200mA Current Limit
- Reverse Current Limit
- Very Low Quiescent Current: 100μA (Typ.)
- Output Over-voltage Protection
- Under-Voltage Lockout
- Thermal Shutdown
- 8kV ESD Rating
- Package: SOT23

3. Applications

- Laptop/Desktop Computers and Netbooks
- Smart Phones and PDAs
- LCD TVs and Monitors
- Set-Top-Boxes, Residential Gateways
- Printers, Docking Stations, HUBs
- USB Memory Drives
- USB Hubs

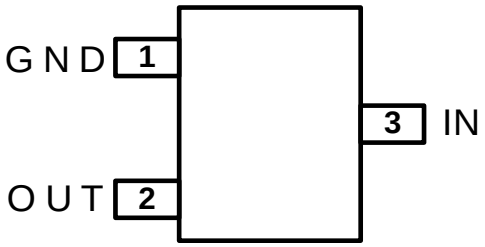
4. Typical Application



NOTE 1: Tantalum or Aluminum Electrolytic capacitors (C_{IN} and C_{OUT}) may be required for USB applications

5. Pin Configuration

(Top View)



SOT23

6.Pin Description

PIN NUMBER	PIN NAME	I/O	PIN FUNCTION
1	GND		Common ground.
2	OUT	O	Switch output.
3	IN	I	Switch input.

7. Absolute Maximum Ratings [2]

T_A=25℃, unless otherwise noted.

SYMBOL	PARAMETER	RATING	UNIT
V_{IN}	IN Voltage	-0.3 to 6	V
V_{OUT}	OUT Voltage	-0.3 to V_{IN} + 0.3	V
I_{OUT}	OUT Current	Internal Limited	A
P_D	Power Dissipation	300	mW
$R_{\theta JA}$	Junction-to-ambient Thermal Resistance	250	℃/W
$T_{J(MAX)}$	Operating Junction Temperature	150	℃
T_{STG}	Storage Temperature	-65 to 150	℃
T_{SDR}	Lead Temperature (Soldering, 10 sec)	260	℃
V_{ESD}	HBM	8000	V

NOTE 2: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

8. Recommended Operating Conditions

SYMBOL	PARAMETER	MIN	MAX	UNIT
V_{IN}	Input Voltage	2.5	5.2	V
I_{OUT}	Output Current		150	mA
T_A	Operating Ambient Temperature	-40	85	℃
T_J	Operating Junction Temperature	-40	125	℃

9. Electrical Characteristics

(V_{IN} = 5 V, C_{IN}=1μF, C_{OUT}=1μF, T_A=25℃, unless otherwise noted)

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_Q	Quiescent Current			100	140	μA
$R_{DS(ON)}$	Switch on-resistance	V_{IN}=5V, I_{OUT}=0.1 A	100	250	350	mΩ
I_{LIM}	Current Limit	V_{IN}=5V	160	200	240	mA
V_{UVLO}	Input UVLO Threshold	V_{IN} rising	1.4	1.8	2.2	V
V_{UVLO_HYS}	Input UVLO Hysteresis			0.01		V
I_{REV}	Reverse Leakage Current	V_{IN} = 0V, V_{OUT} = 5V, I_{REV} at V_{IN}		0.1	1	μA
I_{ROCP}	Reverse-Current Trigger Point	V_{IN} = 5.0V, V_{OUT} = 5.2V		0.1		A
t_{TRIG}	Deglitch time from reverse current trigger to MOSFET turn off [3]		0.5	0.7	1.0	ms
V_{OVP}	Output over-voltage trip point [4]	V_{IN} Rising, OUT floating	5.3		5.6	V
t_R	Output Turn-on Rise Time	R_{LOAD}=100Ω	0.2	0.4	0.8	ms
T_{SHDN}	Thermal Shutdown Threshold [5]			150		℃
T_{HYS}	Thermal shutdown hysteresis [5]			20		℃

NOTE 3: When reverse current triggers at I_{ROCP} = 0.10A, the reverse current is continuously clamped at I_{ROCP} for 0.7ms deglitch time until MOSFET is turned off.

NOTE 4: During output over-voltage protection, the output draws approximately 60μA current.

NOTE 5: Guaranteed by design.

10. Typical Performance Characteristics

(V_{IN} = 5V, C_{IN}=1μF, C_{OUT}=1μF, T_A=25℃, unless otherwise noted)

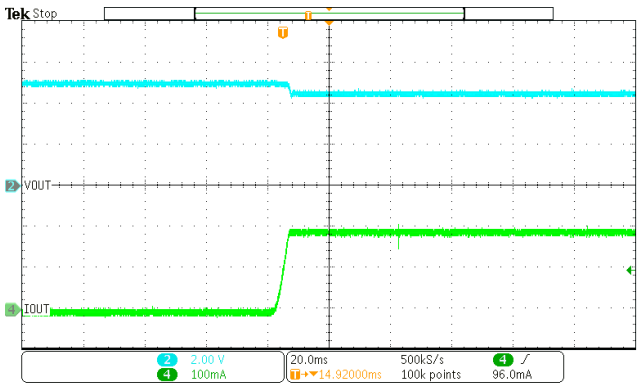


Figure 1. Overload Current-Limit

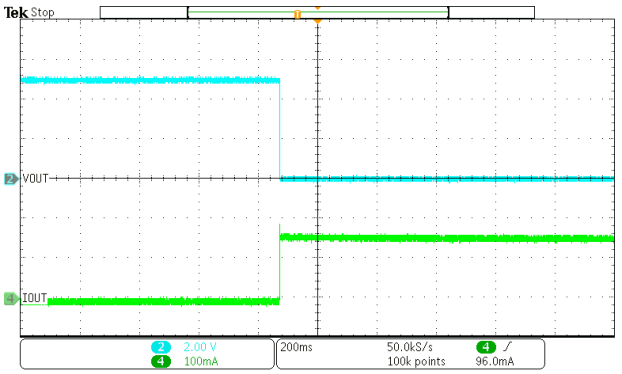


Figure 2. Short Current Response

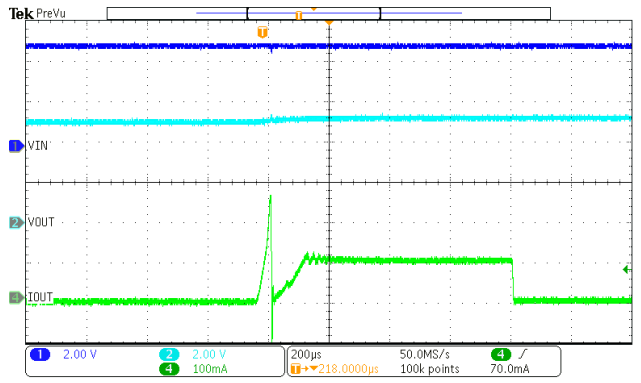


Figure 3. Reverse-Current Limit

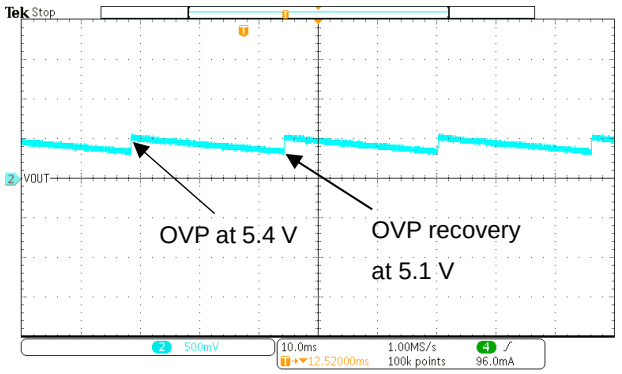


Figure 4. Output Over-Voltage Trip Point

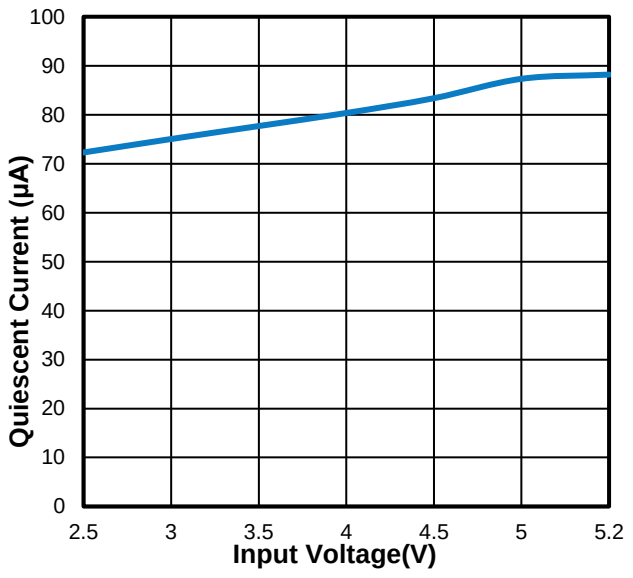


Figure 5. Quiescent Current vs. Input Voltage

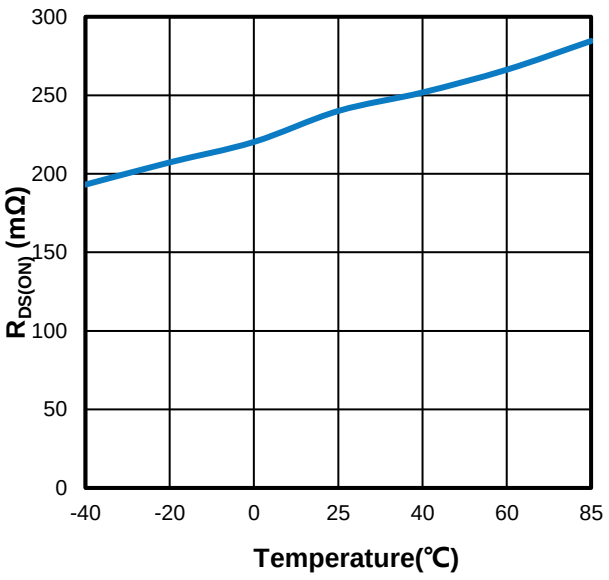


Figure 6. Switch On-Resistance vs. Ambient Temperature

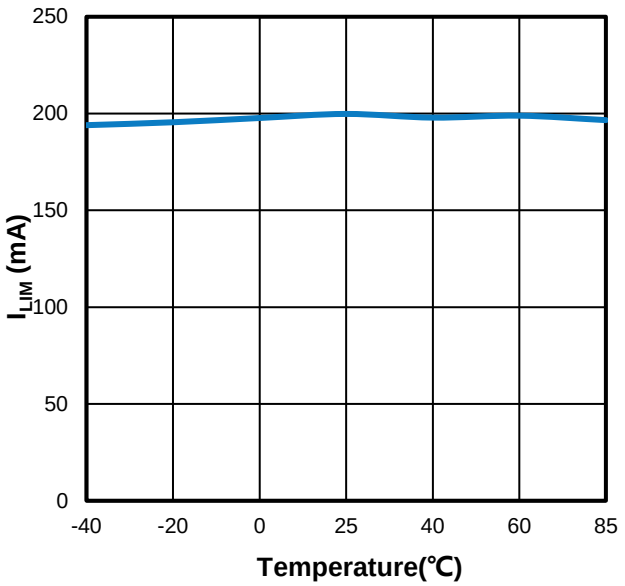


Figure 7. Current Limit vs. Ambient Temperature

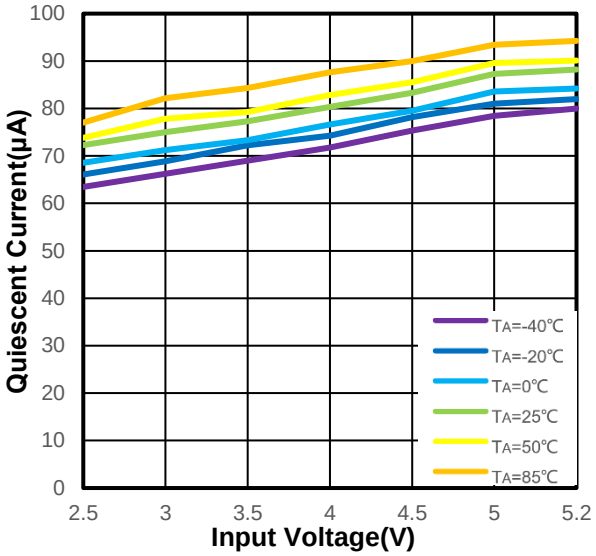


Figure 8. Quiescent Current vs. Input Voltage vs. Ambient Temperature

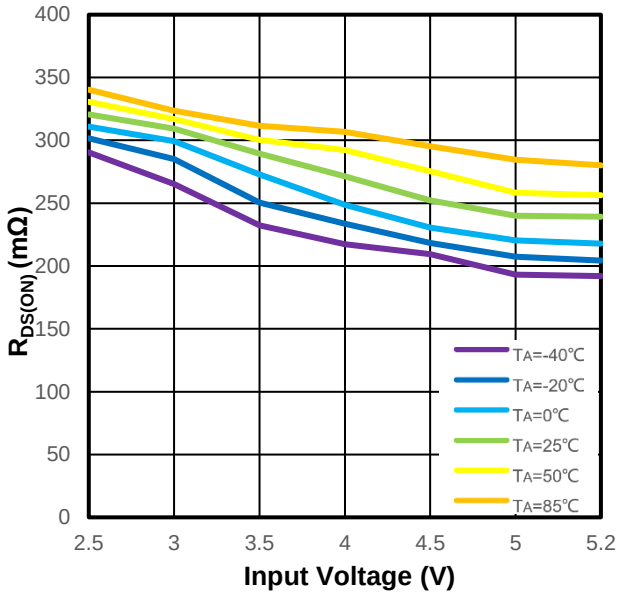


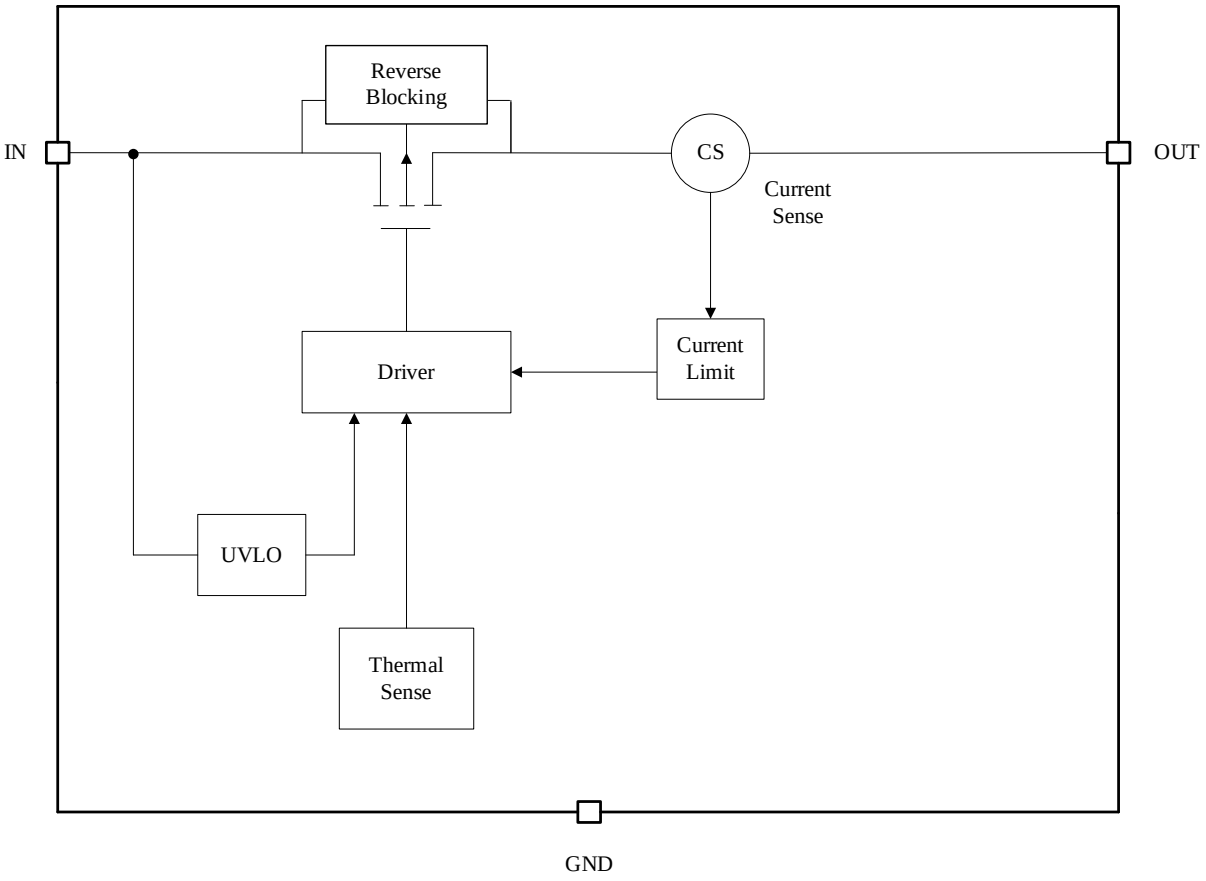
Figure 9. Switch On-Resistance vs. Input Voltage vs. Ambient Temperature

11. Function Description

11.1 Overview

The WP250152S3-B load switches are 5.2V, current limited load switches in a SOT23 package. The devices contain a 250 mΩ current-limited P-channel MOSFET that can operate over an input voltage range of 2.5 V to 5.2V. When the switch current reaches the maximum limit, the WP250152S3-B operates in a constant-current mode to prohibit excessive currents from causing damage. WP250152S3-B has a current limit of 200 mA.

11.2 Block Diagram



11.3 Feature Description

11.3.1 Current Limiting

When the switch current reaches the maximum limit, the WP250152S3-B operates in a constant-current mode to prohibit excessive currents from causing damage.

11.3.2 Thermal Shutdown

Thermal shutdown protects the device from internally or externally generated excessive temperatures. During an overtemperature condition the switch is turned off. The switch automatically turns on again if the temperature of the die drops below the threshold temperature.

12. Application and Implementation

12.1 Application Information

12.1.1 Input Capacitor

To limit the voltage drop on the input supply caused by transient inrush current, a capacitor 1μF or larger must be placed between the IN and GND pins.

12.1.2 Output Capacitor

A 1μF or larger capacitor should be placed between the OUT and GND pins. This capacitor will prevent parasitic board inductances from forcing OUT below GND when the switch turns off.

12.1.3 Undervoltage Lockout

The undervoltage lockout turns off the switch if the input voltage drops below the undervoltage lockout threshold. Under-voltage detection functions only when the switch is enabled.

12.1.4 Power Dissipation and Junction Temperature

The junction temperature of the switch depend on several factors such as the load, PCB layout, ambient temperature and package type. Power dissipation can be calculated based on the output current and the $R_{DS(ON)}$ of the switch as below.

$$P_D = R_{DS(ON)} \times I^2$$

The junction temperature can be estimated by the following thermal equation:

$$T_J = P_D \times R_{\theta JA} + T_A$$

Where:

T_A = Ambient temperature
$R_{\theta JA}$ = Thermal resistance
P_D = Total power dissipation

With all possible conditions, the junction temperature must be within the range specified under operating conditions. The maximum output current must be derated at higher ambient temperature to ensure the junction temperature does not exceed the maximum junction temperature which is 125℃.

12.1.5 Over-Voltage Protection

The device has an output over-voltage protection that triggers when the output voltage reaches output over-voltage trip point. When this fault condition stays on for longer than 15μs, (This is called the “Debounce time from output over voltage to MOSFET turn off”) output device is disabled and shut down. Recovery from Over-Voltage Protection occurs when the output voltage falls to 101% of input voltage.

12.1.6 Reverse-Current Protection

The USB specification does not allow an output device to source current back into the USB port. In a normal MOSFET switch, current will flow in reverse direction (from the output side to the input side) When the output voltage exceeds than input voltage. A reverse current limit feature is implemented in the WP250152S3-B to limit such back currents. Reverse current limit is always active. Reverse current is limited to half of the I_{LIM} level and when the fault exists for more than 700μs, output device is disabled and shut down. This is called the "Deglitch time from reverse current trigger to MOSFET turn off.” The MOSFET will turn on again when the output voltage returns to 101% of input voltage.

13. Power Supply Recommendations

The device is designed to operate from a V_{IN} range of 2.5 V to 5.2 V. This supply must be well regulated and placed as close to the device terminal as possible with the recommended 1μF bypass capacitor. If the supply is located more than a few inches from the device terminals, additional bulk capacitance may be required in addition to the ceramic bypass capacitors. If additional bulk capacitance is required, an electrolytic, tantalum, or ceramic capacitor of 10 μF may be sufficient.

14. Evaluation Modules

Evaluation Modules (EVMs) are available to help evaluate the device performance. We have evaluation modules for different packages, you can contact us to get the evaluation module or schematic.

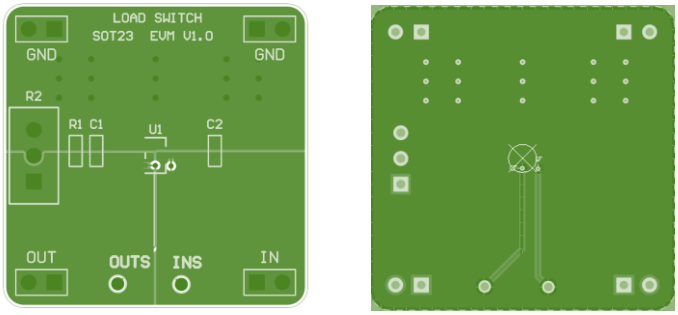
The modules are listed in the following table.

NAME	PACKAGE	EVALUATION MODULE
WP250152S3-B	SOT23	LOAD SWITCH SOT23 EVM V1.0

Layout Guidelines

For best performance, all traces should be as short as possible, the input and output capacitors should be placed close to the device to minimize the effects that parasitic trace inductances may have on normal and short-circuit operation. Using wide traces for V_{IN}, V_{OUT}, and GND will help minimize parasitic electrical effects and minimize the case to ambient thermal impedance.

Layout Example



15. Naming Conventions

WP AB CCC D EE - F

WP: WAYON Protection IC;

A: Product Category –2: Load Switch;

B: Maximum Output Voltage – 5: ＜6V;

CCC: Maximum Output Current – 015:150mA;

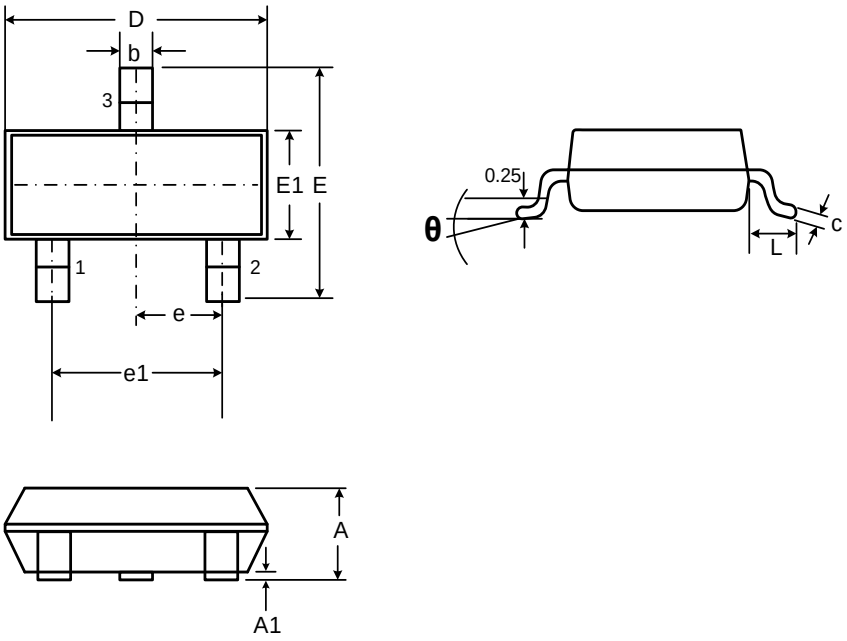
D: Serial number;

EE: Package – S3: SOT23;

F: Current Limit Accuracy – B: 20%

16. Package Information

SOT 23



SYMBOL	DIMENSIONS IN MILLIMETERS	
	MIN	MAX
A	0.90	1.15
A1	0.00	0.10
b	0.30	0.50
c	0.07	0.15
D	2.80	3.04
E	2.25	2.64
E1	1.20	1.40
e	0.95BSC	
e1	1.80	2.00
L	0.55REF	
θ	0°	8°

17. Ordering Information

PART NUMBER	CURRENT LIMIT	PACKAGE	PACKING QUANTITY	MARKING*
WP250152S3-B	200mA	SOT23	3k/Reel	250152 BXXXX

* XXXX is variable.

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For additional information, please contact your local Sales Representative.
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Specifications are subject to change without notice.
The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time.
Users should verify actual device performance in their specific applications.

Product Specification Statement

- The product specification aims to provide users with a reference regarding various product parameters, performance, and usage. It presents certain aspects of the product's performance in graphical form and is intended solely for users to select product and make product comparisons, enabling users to better understand and evaluate the characteristics and advantages of the product. It does not constitute any commitment, warranty, or guarantee.
- The product parameters described in the product specification are numerical values, characteristics, and functions obtained through actual testing or theoretical calculations of the product in an independent or ideal state. Due to the complexity of product applications and variations in test conditions and equipment, there may be slight fluctuations in parameter test values. WAYON shall not guarantee that the actual performance of the product when installed in the customer's system or equipment will be entirely consistent with the product specification, especially concerning dynamic parameters. It is recommended that users consult with professionals for product selection and system design. Users should also thoroughly validate and assess whether the actual parameters and performance when installed in their respective systems or equipment meet their requirements or expectations. Additionally, users should exercise caution in verifying product compatibility issues, and WAYON assumes no responsibility for the application of the product.
- WAYON strives to provide accurate and up-to-date information to the best of our ability. However, due to technical, human, or other reasons, WAYON cannot guarantee that the information provided in the product specification is entirely accurate and error-free. WAYON shall not be held responsible for any losses or damages resulting from the use or reliance on any information in these product specifications. WAYON reserves the right to revise or update the product specification and the products at any time without prior notice, and the user's continued use of the product specification is considered an acceptance of these revisions and updates. Prior to purchasing and using the product, users should verify the above information with WAYON to ensure that the product specification is the most current, effective, and complete. If users are particularly concerned about product parameters, please consult WAYON in detail or request relevant product test reports. Any data not explicitly mentioned in the product specification shall be subject to separate agreement.
- Users are advised to pay attention to the parameter limit values specified in the product specification and maintain a certain margin in design or application to ensure that the product does not exceed the parameter limit values defined in the product specification. This precaution should be taken to avoid exceeding one or more of the limit values, which may result in permanent irreversible damage to the product, ultimately affecting the quality and reliability of the system or equipment.
- The design of the product is intended to meet civilian needs and is not guaranteed for use in harsh environments or precision equipment. It is not recommended for use in systems or equipment such as medical devices, aircraft, nuclear power, and similar systems, where failures in these systems or equipment could reasonably be expected to result in personal injury. WAYON shall assume no responsibility for any consequences resulting from such usage.
- Users should also comply with relevant laws, regulations, policies, and standards when using the product specification. Users are responsible for the risks and liabilities arising from the use of the product specification and must ensure that it is not used for illegal purposes. Additionally, users should respect the intellectual property rights related to the product specification and refrain from infringing upon any third-party legal rights. WAYON shall assume no responsibility for any disputes or controversies arising from the above-mentioned issues in any form.